



CASE STUDY: Awards of Excellence for Affordable Housing Built Responsibly

Rural Development, Inc.'s Affordable Green Homes



Affordable Green Homes

Rural Development, Inc. (RDI) is a non-profit builder of affordable housing located in Montague, MA. By the end of 2004, RDI had developed over 79 single family homes for people of low, moderate and middle incomes over the course of 15 years. Forty-eight of these projects have been certified as Energy Star Homes. RDI is committed to energy efficiency, and now views the Energy Star standard as a minimum level of efficiency for their projects. Affordable Green Homes consists of five scattered site, single-family homes in various towns in Western Massachusetts. All five of the homes were offered in waiting list order to qualified homebuyers, come with a 15 year affordability rider on the deed, and were developed using an integrated design process and the Energy Star standard. Two of the five houses incorporated renewable technologies by installing photovoltaic systems.

Greening Goals:

The primary greening goal of this project was to provide low-income families in Western Massachusetts with the opportunity to purchase energy efficient, healthy homes. RDI was also very interested in demonstrating the feasibility and replicability of photovoltaic energy systems on affordable homes and promoting the idea of sustainable construction among the next generation of builders.

Integrated Design Process:

An integrated design process was utilized from the project conception. The project manager, architect, civil and mechanical engineers, development consultant, solar consultant and plumber met on several occasions to discuss the project goals and feasibility of design approaches, and to make joint decisions. In addition, the local planning, health and conservation boards met with RDI early on to provide input and advice as it related to the permitting process.

Project at a Glance

Location: Greenfield, Leyden, Bernardston, Millers Falls and Erving, Massachusetts

Project Type: New Construction, Single-Family homes

Ownership/Rental: Ownership

Size:

5 houses (3-4 BR)

6363 total sq. ft.

3 acre site, <2 units/acre

Affordability: All sold to homebuyers at 46-58% of the area median income.

Project Completion Date (5 homes): December 3, 2004.

Project Team:

Developer: Rural Development, Inc.

Architect: Austin Design, Inc.

Construction Manager: Rural Development, Inc.

Development Cost:

Land Cost	\$138,000
Construction costs:	\$532,060
Soft costs:	\$172,896
Total:	\$842,956

Cost/Savings of Greening:

Documented increased Cost of Greening (for upgrades):	\$42,833
Rebates and Grants for upgrades:	\$42,833
Net Cost of Greening:	None

Standard Used: Energy Star Homes

Key Green Features:

- Integrated design process
- Photovoltaic systems
- Energy Star standard
- Highly efficient technologies for energy and water conservation

Green Features

Site Design/Landscape Planning:

RDI seeks to minimize environmental disturbance during the construction process and keep intact as much of the existing vegetation as possible. The five sites each had specific siting challenges due to their scattered nature. Managing run-off was a common issue across all five sites due to their location in Western Massachusetts, with its significant precipitation. Run-off was dealt with by using gutters, downspouts, and grading swales to divert water away from the homes and into nearby wetlands. Since several of the homes incorporated solar photovoltaics, solar access was carefully considered during the feasibility study phase. In addition, each of these sites had to be individually evaluated for their impact on local open space requirements. Meetings with local conservation boards established over six acres of open space to be protected from development in perpetuity, and open space protections are written into the deeds of several of the properties in this project.

Location & Linkages:

Franklin County is the most rural county in Massachusetts and the homes built by RDI are consistent with the character of that region. Given that, an effort was made to make these properties as accessible to commercial areas, services and schools as possible.

Building Design Greening:

Energy: The focus of this project was to build the most energy efficient, healthy, affordable homes possible. As such, the greening strategies focused on the heating systems, insulation, ventilation, and renewable energy systems. In Greenfield, MA, which has natural gas service, a boiler with an efficiency rating of 85.2% was installed. In the Leyden and Bernardston houses, gas-fired boilers that use liquid propane, are fully condensing and modulated, and have 94.5% efficiency ratings were used. In the Millers Falls and Erving homes, oil-fired boilers were used (a modulator was not used in the Millers Falls home). While the high efficiency boilers produced energy savings, the greatest efficiency savings were due to the installation of indoor/outdoor modulators. Modulators allow the boiler to adjust the water temperature according to demand and the outdoor and indoor temperature, ensuring that the water in the boilers is not over heated, which saves energy.

Other energy efficiency strategies included installation of efficient blown-in insulation and rigorous air sealing, advanced framing techniques, efficient windows, and compact fluorescent lighting. Energy Star rated appliances were recommended to the buyers, and all but one homebuyer (who did not need to buy new appliances) installed Energy Star appliances.

Two of the five homes have nominal 1 KW solar photovoltaic systems, funded by a grant from the Massachusetts Renewable Energy Trust. These systems produce energy and financial savings, and require very little maintenance.



Indoor Environmental Air Quality: RDI required contractors to pay close attention to moisture control and air changes. They installed cabinetry that uses only solid plywood to avoid the potentially harmful off-gassing associated with cabinets made of particle board. All of the kitchen and bathroom fans were vented to the exterior. Moisture was controlled by paying attention to the roofing and flashing detail, using soffit and ridge vents, waterproofing the foundations, installing dehumidifiers that drained to storm drains/sump holes, using porous backfill around the foundations, grading away from the homes, and using sealed vapor barriers to prevent the migration of water through exterior walls and ceilings.

Resource Conservation/Materials: The green materials used in this project include: recycled cellulose insulation, (oriented strand board from waste or low grade wood fiber) and gravel driveways. In addition, construction waste, such as lumber, cardboard, and metal, was recycled.

Water Conservation: Low-flow fixtures were installed in all of the homes, including: 1.6 gallon per flush toilets with glazed traps, 2.5 gallon per minute shower heads, and 1.5 gallon per minute faucet aerators for the kitchen and bathroom sinks.

Commissioning: Commissioning was an important part of this project. It ensured that the new heating systems and the solar photovoltaic systems were installed prop-

Green Highlights

- Energy Star Homes standard
- High-efficiency boilers
- Indoor/outdoor boiler modulators (3 of the 5 homes)
- Blown-in recycled cellulose insulation
- 2x6 wood frame construction
- Low-e, argon filled windows with a U value of .31
- Compact fluorescent lighting
- Energy Star rated appliances (in 4 of the 5 homes)
- 1 KW solar photovoltaic systems (2 of the 5 homes)
- Low-flow water fixtures
- Solid plywood cabinetry
- Oriented Strand Board (OSB) panels



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Green Features



erly and worked according to their specifications. The positive relationship that RDI built with the commissioning agent and his firm continued through work on subsequent RDI projects.

Resident Education: A variety of owner's manuals were created and distributed to homeowners to educate them about their homes. Residents were given manuals for all of the systems by the installers as well as an Energy Star Homes manual. The two homes with solar panels were provided with a manual that used both technical and non-technical language to describe the systems and troubleshoot problems. Homeowners were required to do construction cleanup of their properties as

part of their sweat-equity contribution. During this process they were taught about construction waste recycling.

Project Financing:

Rural Development Inc. received funds from the Massachusetts Department of Housing and Community Development's HOME loan program, the Housing Assistance Council's SHOP loan, rebates from local utilities for Energy Star Homes upgrades, a grant from the Massachusetts Technology Collaborative, and homebuyers' donations of land, labor, and cash. Mortgages came from a local bank (Greenfield Cooperative Bank) and the USDA Rural Development 502 mortgage through their Rural Home Loan Partnership program.

Cost of Greening the Project:

The cost associated with meeting the Energy Star standards and reducing the energy usage of five homes was \$17,071 (approximately \$3,000 per home). The two PV systems added \$25,762 in costs. Note that RDI does not consider these to be an incremental cost, as they plan to build all future homes to Energy Star standards.

Sources of Funding/Rebates:

All of the costs of greening quantified above were covered through grants and rebates. The Massachusetts Technology Collaborative awarded a grant that covered the full cost of the PV systems for the Bernardston and Leyden homes as well as \$2000 for their Energy Star upgrades. The remaining Energy Star upgrade costs for these two homes as well as the full costs for the remaining three homes were covered by rebates from the Western Massachusetts Electric Company. In addition, the families who bought the houses with PV participated in the installation, as did some community members.

Life-Cycle Cost Analysis:

RDI did not have the capacity or the funding to conduct a full LCA, however, they did analyze the costs and benefits of the green choices they were making as the project progressed.

Occupant Satisfaction:

"As a carpenter, I can appreciate all of the efforts that went into my home. This place truly is a dream come true for my family."

-Affordable Green Home Owner

Measurable Benefits

High Efficiency Boilers: Monetary value of savings is estimated at \$178/year in the Millers Falls home, \$249/year in the Erving home, \$466/year in the Leyden home, \$454/year in the Bernardston home, and \$343/year in the home in Greenfield, representing 20-25% of annual fuel costs.

Solar Photovoltaic Systems: The systems in the Leyden and Bernardston units are estimated to generate approximately 1,000 KWH per year each. Energy production data is collected on a monthly basis by RDI and will be monitored by the Renewable Energy Trust for the next five years. It is estimated that the owners can also gain about \$60/year on the sale of Renewable Energy Credits (REC's).

Energy Efficiency: Energy Star Home standard: HERS ratings range from 88.9 to 91.5.





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Looking Ahead

Challenges:

The greatest challenge faced by this project, as is the case in so many other affordable housing projects, was on the financing side. There is no lack of will on the part of RDI to build green housing that is within reach of families of modest means. But with the cut-backs in funding for affordable housing (both at the state and federal levels), it is very difficult to finance even projects that are standard and pay no attention to green. Fortunately, RDI has built relationships with contractors, architects, engineers, and other building professionals that bring the construction costs for their housing in-line with what other developers are paying to build non-green. The challenge will be how to finance the constant desire to improve upon their projects and build even greener housing.

Partnerships:

RDI now boasts close relationships with various contractors and consultants on the project. In particular, they feel that the relationship with the commissioning agent has been very beneficial; and the partnership continues beyond this project. Their relationship with the local utilities (National Grid and Western Mass Electric) has also grown as a result of this project.

One particularly notable partnership is that with the Franklin County Technical School. The students, supervised by faculty, assisted with carpentry, plumbing, HVAC and electric systems, and installation of the solar photovoltaic systems on one of the homes, with RDI paying for 15% of the materials that they use. The students will participate in the installation of a 3KW solar system and dual flush toilets in an upcoming RDI project. The contractors that were employed for this project have also become part of the close-knit pool of professionals that RDI uses on all of its projects. The students are comfortable with green building techniques and are interested in expanding their knowledge in this area.

Policy/Practice Implications:

During the course of this project, RDI learned that, at least for the time being, grant funds are crucial for making housing both green and affordable. More funds need to be identified in order to incorporate a broader range of green materials, such as bamboo flooring and cement-based siding. This project is an example of how leveraging utility money and various types of grants can make highly energy efficient, affordable homes possible.

“RDI’s program demonstrates an excellent understanding of the housing needs of low-income families struggling to become homeowners. Their commitment to green building through use of an integrated design process, innovative building techniques, and development of internal construction capacity is a commendable model.”

- Member, Awards Advisory Committee

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